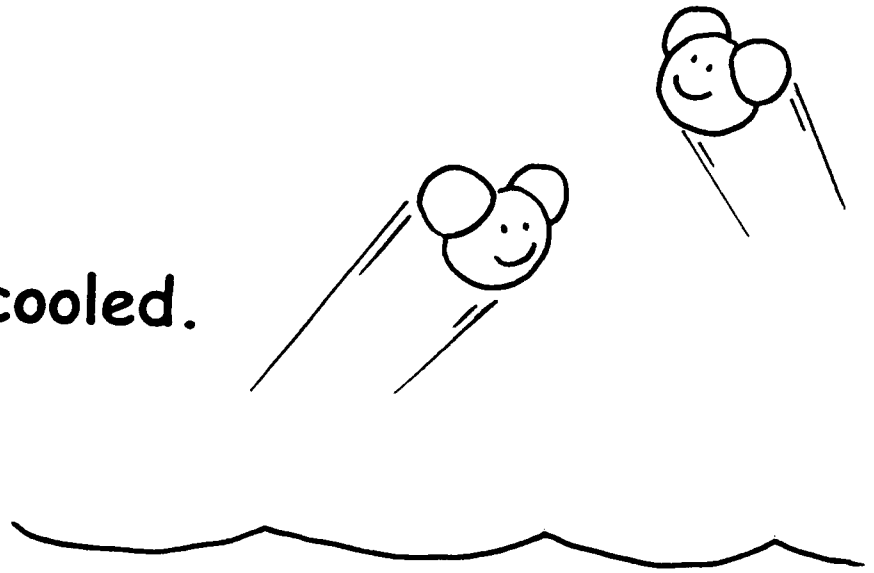
# NEXT-TIME QUESTION

When evaporation of water occurs, the faster-moving (more energetic) water molecules escape the liquid and become molecules in the air. The average kinetic energy of molecules remaining in the liquid is lowered. The water is cooled.

Normally, the air that receives the escaping molecules is

a) warmed.
b) cooled.
c) neither warmed nor cooled.



Thanx to John Suchocki

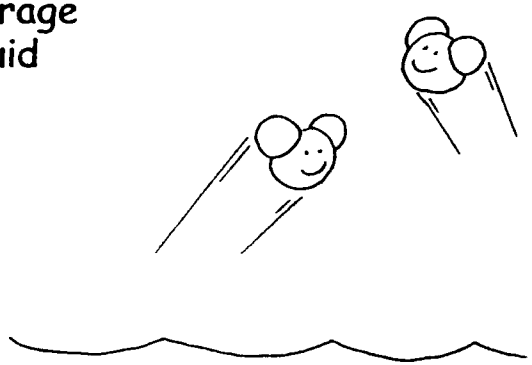


CONCEPTUAL Physics

# NEXT-TIME QUESTION

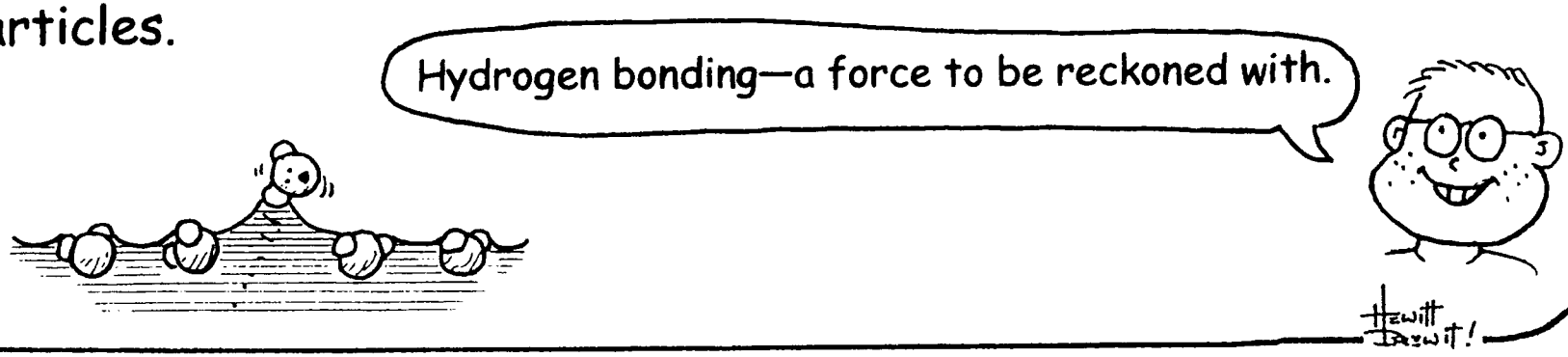
When evaporation of water occurs, the faster-moving (more energetic) water molecules escape the liquid and become molecules in the air. The average kinetic energy of molecules remaining in the liquid is lowered. The water is cooled.

Normally, the air that receives the escaping molecules is



a) warmed.
b) cooled.
c) neither warmed nor cooled.

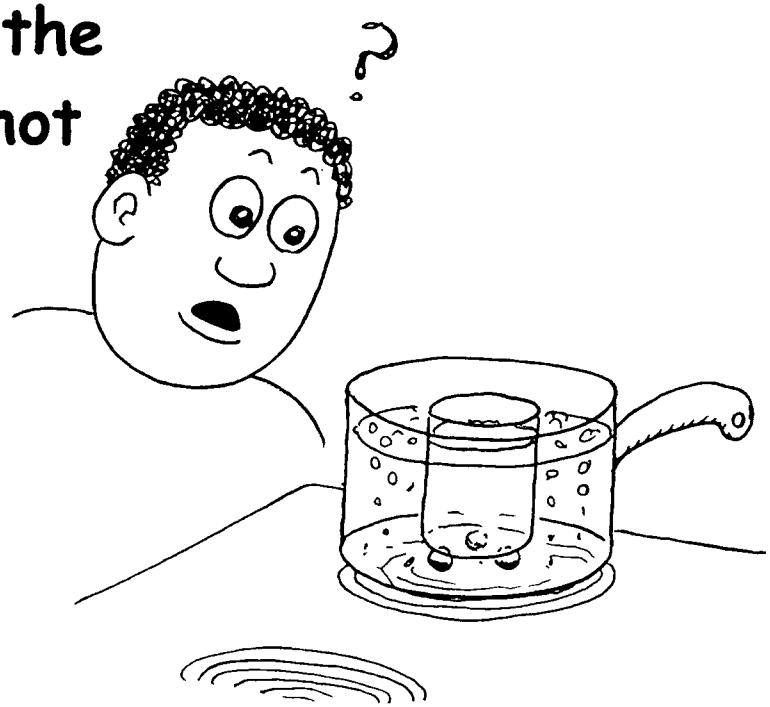
**Answer, b:**
Molecules that escape the liquid and enter the gaseous phase are considerably slowed in overcoming hydrogen bonding at the water surface—reducing their initially high kinetic energy. The air is therefore cooled as it collects these slower moving gaseous particles.



# NEXT-TIME QUESTION

CONCEPTUAL Physics

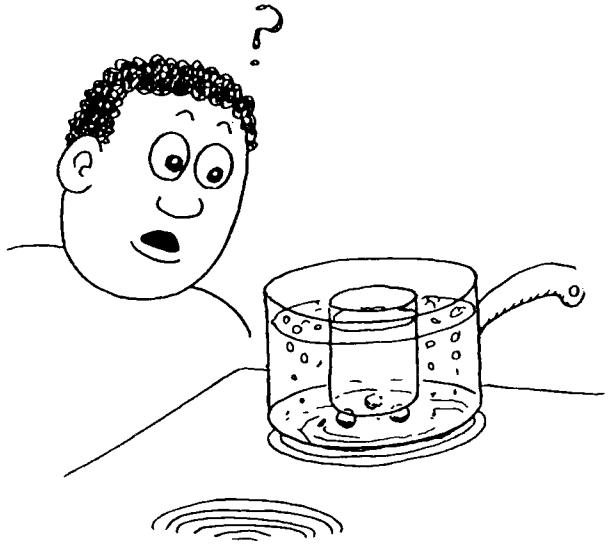
Place a jar of water in a saucepan of water so the bottom of the jar is held above the bottom of the pan. Then put the pan on a hot stove and the water in the pan will come to a boil. But the water in the jar won't. Why?



# NEXT-TIME QUESTION

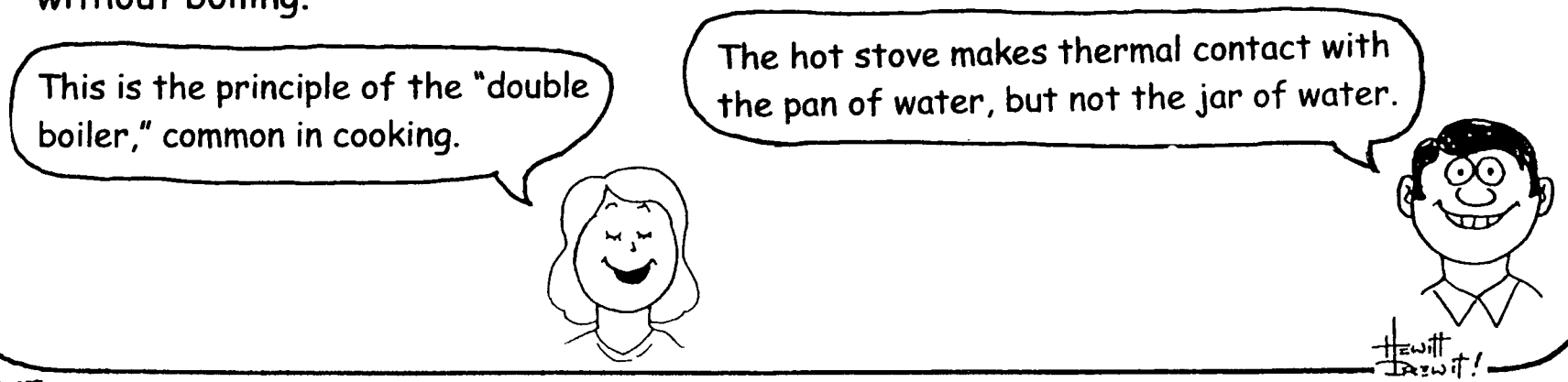


**Place a jar of water in a saucepan of water so the bottom of the jar is held above the bottom of the pan. Then put the pan on a hot stove and the water in the pan will come to a boil. But the water in the jar won't. Why?**



Answer:

The stove temperature is normally much higher than 100°C, which brings water in the saucepan to boiling. But when the water in the jar, insulated from the stove surface, reaches 100°C, further heat doesn't enter it because it is in thermal equilibrium with the surrounding 100°C boiling water. Without further heat input, it remains at 100°C without boiling.



# NEXT-TIME QUESTION

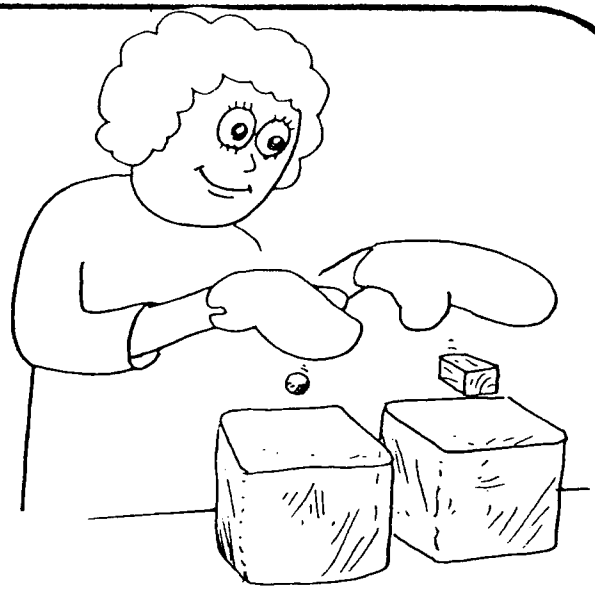
A piece of metal and a piece of wood of equal mass and equal temperature are removed from a hot oven and dropped onto blocks of ice. Which will melt more ice before cooling to the ice temperature?

a) The metal.
b) The wood.
c) Both will melt equal amounts of ice.

# NEXT-TIME QUESTION

**A piece of metal and a piece of wood of equal mass and equal temperature are removed from a hot oven and dropped onto blocks of ice. Which will melt more ice before cooling to the ice temperature?**

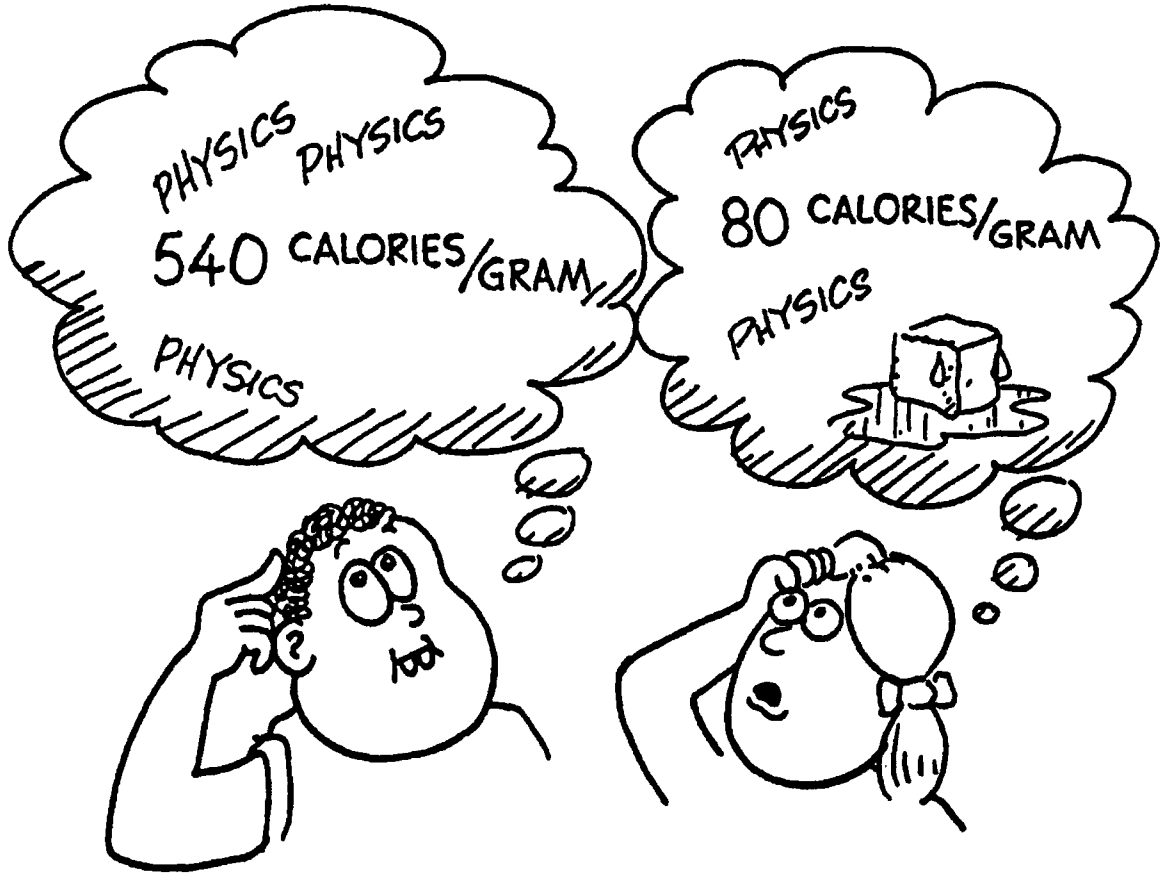
a) The metal.
b) The wood.
c) Both will melt equal amounts of ice.




**Answer: b.**
The wood will melt more ice because of its greater specific heat capacity. It releases more energy per degree than the lower-heat-capacity piece of iron.

# NEXT-TIME QUESTION

WHAT IS THE MINIMUM AMOUNT OF 100°C STEAM REQUIRED TO MELT 1 GRAM OF 10°C ICE?








HEWITT DREW-IT!

# NEXT-TIME QUESTION

WHAT IS THE MINIMUM AMOUNT OF 100°C STEAM REQUIRED TO MELT 1 GRAM OF 10°C ICE?

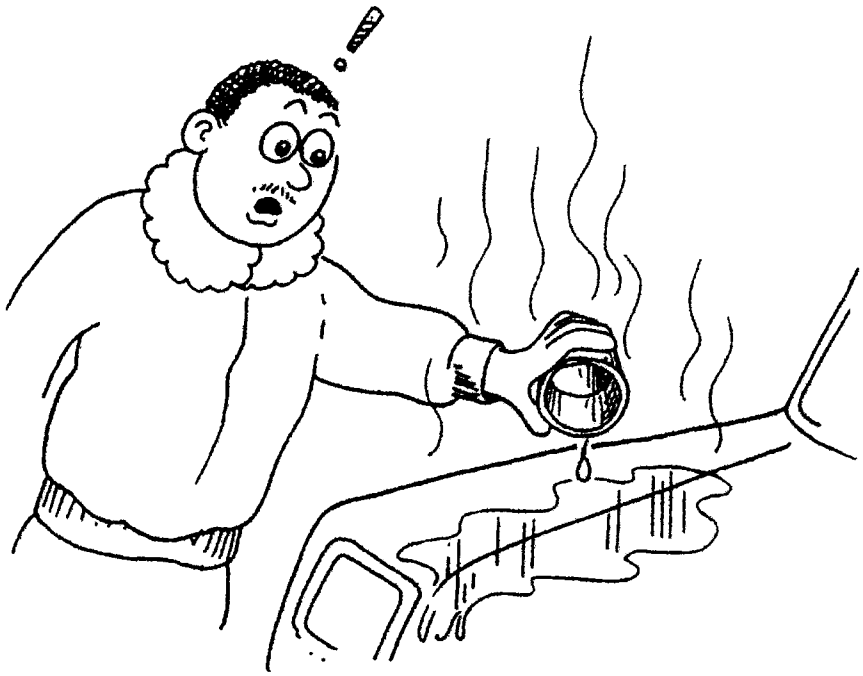

## Answer:

0.125 gram of 100°C steam will provide the 89 calories required to melt 1 gram of ice. The $H_2O$ in the form of steam will give up 540 calories per gram when it condenses to boiling water, and another 100 calories per gram when the water is cooled from 100°C to 0°C. So the steam will give up a total of 640 calories per gram to the ice. But the ice needs only 80 calories to melt. So only 80/640 gram (0.125 gram) of steam will do the job.

Hewitt Drew-it!

# NEXT-TIME QUESTION

SUPPOSE 4 GRAMS OF BOILING WATER ARE SPREAD OVER A LARGE SURFACE SO 1 GRAM RAPIDLY EVAPORATES. IF EVAPORATION TAKES 540 CALORIES FROM THE REMAINING 3 GRAMS OF WATER, AND NO OTHER HEAT TRANSFER TAKES PLACE, WHAT WILL BE THE TEMPERATURE OF THE REMAINING 3 GRAMS?

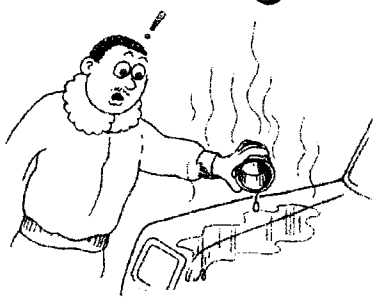






Hewitt Drawit!

# NEXT-TIME QUESTION



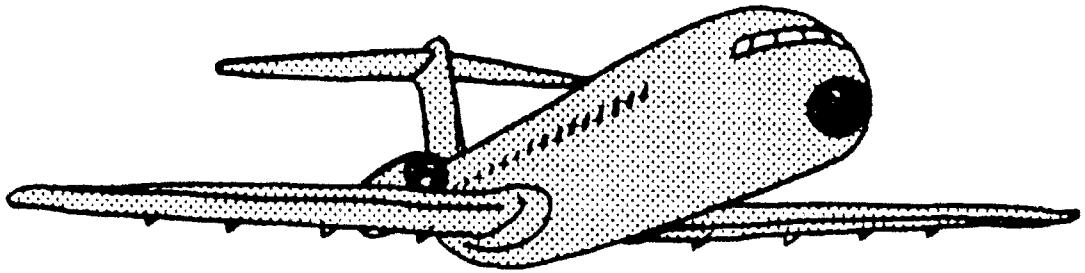
SUPPOSE 4 GRAMS OF BOILING WATER ARE SPREAD OVER A LARGE SURFACE SO 1 GRAM RAPIDLY EVAPORATES. IF EVAPORATION TAKES 540 CALORIES FROM THE REMAINING 3 GRAMS OF WATER, AND NO OTHER HEAT TRANSFER TAKES PLACE, WHAT WILL BE THE TEMPERATURE OF THE REMAINING 3 GRAMS?

**Answer:**

The remaining 3 grams will turn to 0°C ice under conditions where all 540 calories are taken from the remaining water (like when the surroundings are below freezing and don't contribute energy). 540 calories from 3 grams means each gram gives up 180 calories. 100 calories from a gram of boiling water reduces its temperature to 0°C, and 80 more calories taken away turns it to ice. This is why hot water so quickly turns to ice in a freezing-cold environment.

Hewitt Drew it!

# NEXT-TIME QUESTION



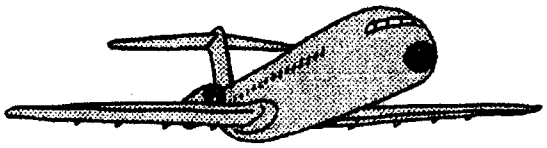
THE AIR TEMPERATURE AT AN ALTITUDE OF 10 KILOMETERS IS A CHILLING -35°C. CABIN TEMPERATURES IN AIRPLANES FLYING AT THIS ALTITUDE ARE COMFORTABLE BECAUSE OF AIR CONDITIONERS RATHER THAN HEATERS. WHY?





Hewitt Drew it!

# NEXT-TIME QUESTION



THE AIR TEMPERATURE AT AN ALTITUDE OF 10 KILOMETERS IS A CHILLING -35°. CABIN TEMPERATURES IN AIRPLANES FLYING AT THIS ALTITUDE ARE COMFORTABLE BECAUSE OF AIR CONDITIONERS RATHER THAN HEATERS. WHY?

## Answer

Airliners have pressurized cabins. The process of stopping compressing outside air to near-sea-level pressures would normally heat the air to a roasting 55°C (130°F). So air conditioners must be used to extract heat from the pressurized air.

Hewitt Drew-it!